MEMORANDUM

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000

Water Division – Northeast

Date: May 18, 2020

To: Jennifer Sincock, EPA COR

From: John O'Donnell, Dave Montali, Mark Sievers

Subject: Task Order 0013, Quality Assurance Report (QAR) for the Water Quality Monitoring in Kentucky Tributaries to the Tug Fork River for Ionic Toxicity TMDL Development

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Tetra Tech completed ten sampling events from seven Kentucky tributaries to Tug Fork River between May 2019 and March 2020. Sampling was conducted on May 29-30, June 4-5, July 2-3, August 26 and 29, September 5-6, October 7-8, and December 11-12, 2019, as well as January 11-12, February 11-12, and March 25-26, 2020. No sampling took place in November 2019. This work was funded by USEPA Region 3 under Contract EP-C-17-046, under Task Order 68HERC19F0025. The period of performance was April 11, 2019 through May 31, 2020.

During the sampling effort, Tetra Tech worked under the Wester Virginia Department of Environmental Protection (WV DEP) Division of Water and Waste Management *Quality Assurance Project Plan [QAPP] for Watershed Assessment Branch Monitoring Activities*. This QAPP was revised by WV DEP in May 2019 for Tug Fork monitoring and approved by the EPA COR for this task order, at the time. Tetra Tech was provided a copy of the WV DEP *Watershed Assessment Branch 2018 Field Sampling Standard Operation Procedures [SOP]*. In addition, the lead Tetra Tech field staff is a retired WV DEP who performed similar monitoring for WV DEP, so he was highly conversant with WV DEP monitoring and quality protocols.

During each sampling event, samples were submitted to Pace Analytical Services in Hurricane, West Virginia for analysis. Pace is a National Environmental Laboratory Accreditation Conference (NELAC) accredited laboratory (Lab Code: TNI00546). Each two-day sampling event included a field support staff member from Pace dispatched , who delivered the samples to the laboratory for analysis at the end of each day.

Monitoring data were subject to a data quality assessment for compliance with the approved analytical methods and project requirements, as well as for overall data quality and qualification of results. Failure of a quality control (QC) element—(e.g., control sample or spiked sample recoveries [positive controls]; trace level contamination in field, method, or instrument blanks [negative controls]; or apparent precision deficit in field or laboratory duplicates)—does not by itself invalidate results, rather it signals that the data reviewer or user should examine the available data and results more closely for potential bias or limitation on its use. A Tetra Tech project quality assurance officer, who is an analytical chemist, reviewed the quality characteristics of each event's sample data and our findings were documented and summarized

in event quality assurance statements, which are attached to this document. Data quality and usability assessments routinely include data qualification based on any deficiencies in measurement system performance. Indications of potential bias and imprecision could impact usability. However, more often than not, apparent measurement system deficiencies are more often associated with the extremely low levels of target analytes than with measurement system performance. None of the data collected under this task order were rejected.

Departures from the technical QA Program included the lack of a duplicate with the first sampling event (May 2019) and a departure in sampling technique for dissolved samples following the June 2019 sampling. A procedural review revealed that collection of dissolved sample aliquots was being performed under pressure, rather than under vacuum. The rationale for filtering samples under vacuum, rather than under pressurized head is the risk of break-through in filtration media. Following discovery, the balance of the sampling for dissolved metals included filtration under negative pressure.

The quality review of data from each event revealed occasional trace level contaminants in field blanks, and an occasional precision deficit. Most often, the apparent precision deficits were the result of comparison of extremely low-level sample concentrations, occasionally between two estimated results (less than the reporting limit, but above the laboratory detection limit), or between one estimated value and one non-detected value. In these cases, it is not unusual to observe precision estimates as high or higher than 100% relative percent difference (%RPD). Data qualification for imprecision was rare, but where a trace level blank contaminant was observed in blanks, most low-level sample results required some qualification. These instances were reported in the event quality assurance statements.

Overall, the data quality for the Water Quality Monitoring in Kentucky Tributaries to the Tug Fork River for Ionic Toxicity TMDL Development sampling are acceptable and have produced data of known and documented quality. Data qualifiers are most associated with low level sample concentrations, which are expected to introduce some uncertainty under ideal circumstances. During this monitoring program, 1,743 field and laboratory measurements were collected and recorded. Of those, 120 required qualification in the laboratory or during our data quality assessment for 7 percent of data qualified. They were primarily qualified as estimated results, but some were qualified as non-detects because those sample concentrations were less than 5 times the concentrations found in the negative control samples (method or field blanks. Most data validation guidelines include a provision for data qualification due to blank contamination. Under an EPA guidance document (USEPA 2007[1]), sample results that are less than 5 times the concentration observed in the blank are qualified undetected at the measured concentration. In other words, because the sample concentration might be indiscernible from potential field or laboratory contamination (depending on the type of blank) the sample analysis is interpreted as a non-detect with a new sample-specific quantitation limit. Where sample results

[1] USEPA 2007. *Solutions to Analytical Chemistry Problems with Clean Water Act Methods.* EPA 821-R-07-002, Analytical Methods Staff, Engineering and Analysis Division, Office of Science and Technology, Office of Water, U.S. Environmental Protection Agency, Washington, DC.

are between 5 and 10 times the blank concentration, the sample concentration is considered an estimate, potentially biased high due to uncertainty as to the potential contribution of the field or laboratory contamination. The same guidance document indicates that sample results greater than 10 times the blank concentration can be reported without qualification, as the potential bias does not exceed natural method variability and is unaffected by the blank result.

As no data were rejected or discarded, overall completeness amounts to 99 percent due to the duplicate sample not collected in May. The attached spreadsheet includes the original laboratory data already sent to EPA with the laboratory data qualifier, but with an added column with a suggested data qualifier from Tetra Tech.

Specific, detailed findings for each individual sampling event were previously delivered to EPA and remain available in Tetra Tech's project files. Our project files also include a comprehensive database including data qualification consistent with Region 3's implementation of EPA's data validation protocols, and calculation verifications for field QC samples.

Sampling Event Data Quality Assessments

- May and June 2019
- July 019
- August 2019
- September 2019
- October 2019
- December 2019
- January 2020
- February 2020
- March 2020

MEMORANDUM

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000
Fax (703) 385-6007

Integrated Water Management

Date: July 19, 2019

To: Cheryl Atkinson, EPA COR

From: Dave Montali, Mark Sievers

Subject: Tug Fork Statement of Quality Assurance – June 2019

Tetra Tech completed two sampling rounds for the Tug Fork River watershed during this reporting period (May 27, 2019 through June 30, 2019). The first event was May 29 and May 30, while the second event was June 4 and June 5. Tetra Tech reviewed the analytical results for potential quality concerns. Below are the major findings of our quality assessment for the two rounds of data.

Water Quality Sampling

- Tetra Tech identified dissolved metals filtration protocol used for first two rounds was not 100 percent consistent with the WV DEP SOP. The method used involved pushing sample through filter, whereas the SOP protocol pulls sample through filter via use of peristaltic pump. There is potential concern that suspended solids will break-through of filter and artificially elevate the dissolved metals results. Tetra Tech discussed the filtration method with WVDEP, who indicated there was no evidence of adverse impact based on the analytical results. WVDEP was ok with Tetra Tech using the alternative filtration method, but Tetra Tech determined best course of action is to use SOP protocol. Proper techniques were used for third round of sampling (in July) and will be for all future events.

Water Quality Analysis

- **Holding Times.** There were no reported missed holding times.
- **Result Qualifiers**. There were several dissolved aluminum and dissolved iron samples over the two sampling events that had concentrations reported that were under the reporting limits. These results were listed as estimated. Similarly, there were two suspended solids concentrations reported under the reporting limit. There were several fecal coliform bacteria results that were listed as estimated.
- **Quality Samples.** Sample blanks were collected on 05/30/19 and 06/05/19. The results for all parameters were under the detection limits. There was a duplicate sample collected on 06/04/19. All duplicate results were within 3 percent of the main sample, except for total aluminum (11 percent), total iron (10 percent), and TSS (67 percent). The original sample had a TSS concentration of 6 mg/L and the duplicate had a concentration of 2 mg/L. This could be the result of the low TSS concentrations and a few extra particles of

sediment in the original sample, which would also account for the slight differences in total aluminum and total iron. The difference in the TSS samples is not seen as a major concern given the low concentrations of the samples and any small difference, could result in a large percent difference.

Review of Results

- Tetra Tech did not identify any quality concerns with the first two rounds of sampling data, even with the different filtration method. As mentioned earlier, Tetra Tech has updated are filtration methodology to better match that of the WV DEP SOPs.

MEMORANDUM

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000
Fax (703) 385-6007

Integrated Water Management

Date: August 27, 2019

To: Cheryl Atkinson, EPA COR

From: Dave Montali, Mark Sievers

Subject: Tug Fork Statement of Quality Assurance – July 2019

Tetra Tech completed one sampling round for the Tug Fork River watershed during this reporting period on July 2 and July 3. Tetra Tech reviewed the analytical results for potential quality concerns. Below are the major findings of our quality assessment for the two rounds of data.

Water Quality Sampling

- No issues or deviations from SOPs/QAPP.

Water Quality Analysis

- **Holding Times.** There were no reported missed holding times in the initial analyses. Two samples, KYBST-33.2-(0.1) and KYBST-28.1-(0.1) were reanalyzed outside of the technical holding times due to laboratory QC issues with the original results. The TDS holding time is 7 days. The laboratory reported that an "additional review of the data from the re-analysis shows that a duplicate was analyzed on sample 1903583-04 with an RPD [relative percent difference] of 0.5%. The standard analyzed with the samples had a percent recovery of 103%." TDS, which primarily measure dissolved minerals in natural waters, is generally not affected over extended periods. However, the results for these two samples are reported as estimated based on the lapsed holding time.
- **Result Qualifiers**. There were several aluminum and iron samples that had concentrations reported that were under the reporting limits. These results were listed as estimated. Similarly, there was a suspended solids concentration reported under the reporting limit. There were two fecal coliform bacteria results that were listed as estimated.
- **Quality Samples.** A sample blanks was collected on 07/03/19. The results for all parameters were under the detection limits, except for aluminum which was estimated as 0.008 mg/L. This was just over the method detection limit (0.005), but less than half the practical quantitation limit (0.02). This concentration was less than 10 times the lowest concentration observed in study samples. In accordance with the guidance in the EPA's Pumpkin Book (USEPA 2007), where blank results are observed at less than 10% of the sample values, results can be confidently reported without qualification.

There was a duplicate sample collected on 07/03/19. The RPD were within 30% for all target analytes, except for TSS and fecal coliform, which were 35% and 49%, respectively. Precision for dissolved aluminum and dissolved iron at 27% and 25%, respectively were based on sample concentrations less than 5 times the reporting limit, where it is not uncommon to observe higher precision estimates. Most of the precision results compared quite favorably and were actually observed to be less than 10%. No additional data qualification was applied due to these observations.

Review of Results

- The holding times for TDS for two samples were exceeded. Results are reported as estimated for these two samples.
- The two duplicate results with RPDs in excess of 30% are likely due to one sample container capturing additional suspended sediment, therefore causing the differences. The variability associated with the additional suspended matter was only apparent in the suspended sediment and bacterial measures, and precision estimates for bacteria are generally more variable than some of the other conventional water quality parameters. All of the rest of the precision estimates were less than or equal to 25%, and only two other estimates exceeded 10% RPD indicating acceptable precision.

US EPA. 2007. *Solutions to Analytical Chemistry Problems with Clean Water Act Methods,* EPA 821-R-07-002, Analytical Methods Staff, Engineering and Analysis Division, Office of Science and Technology, Office of Water, U.S. Environmental Protection Agency, Washington, DC, March 2007. https://www.epa.gov/sites/production/files/2015-08/documents/solutions-analytical-chemistry-problems-cwa-methods_epa_2007_rev_bkmk.pdf

MEMORANDUM

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000
Fax (703) 385-6007

Integrated Water Management

Date: October 7, 2019

To: Cheryl Atkinson, EPA COR

From: John O'Donnell, Dave Montali, Mark Sievers

Subject: Tug Fork Statement of Quality Assurance – August 2019

Tetra Tech completed one sampling round for the Tug Fork River watershed during this reporting period over two days on August 26 and August 29, 2019. Tetra Tech reviewed the analytical results for potential quality concerns. Below are the major findings of our quality assessment for the two rounds of data.

Water Quality Sampling

- No issues or deviations from SOPs/QAPP.

Water Quality Analysis

- **Holding Times.** There were no reported missed holding times in the reported analyses.
- **Result Qualifiers**. Some aluminum, iron, and total suspended solids samples had concentrations reported that were under the reporting limits. These results were listed as estimated. While the analytical method results clearly suggest the presence of these elements or measurement parameters, the values reported are less than the demonstrated range of accuracy and should be considered estimates. Conversely, there were two fecal coliform bacteria results that were listed as estimated due to concentrations exceeding the method range at the measured dilutions. These results should be considered minimum values.
- **Quality Samples.** A field blank sample was collected on 8/26/19. The results for all parameters were less than the laboratory method detection limits, without exception.

  A single field duplicate sample collected for the month on 8/26/19, KYBST-46.4-(0.1) DUP. Precision, as demonstrated by the relative percent difference (RPD) results, were good with only one result in excess of 30% RPD, and 17 of 19 total assessments less than 10 percent. No additional data qualification was applied due to these observations.

Review of Results

- No additional data qualification were added to sample data based on available field or laboratory QC results.

MEMORANDUM

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000
Fax (703) 385-6007

Integrated Water Management

Date: October 8, 2019

To: Cheryl Atkinson, EPA COR

From: John O'Donnell, Dave Montali, Mark Sievers

Subject: Tug Fork Statement of Quality Assurance – September 2019

Tetra Tech completed one sampling round for the Tug Fork River watershed during this reporting period over two days on September 5 and 6, 2019. Tetra Tech reviewed the analytical results for potential quality concerns. Below are the major findings of our quality assessment for the two rounds of data.

Water Quality Sampling

- No issues or deviations from SOPs/QAPP.

Water Quality Analysis

- **Holding Times.** There were no reported missed holding times in the reported analyses.
- **Result Qualifiers**. Several aluminum, iron, and total suspended solids samples had concentrations reported that were under the reporting limits. These results were listed as estimated. While the analytical method results clearly suggest the presence of these elements or measurement parameters, the values reported are less than the demonstrated range of accuracy and should be considered estimates. Conversely, there were two fecal coliform bacteria results that were listed as estimated due to concentrations exceeding the method range at the measured dilutions. These results should be considered minimum values.
- **Quality Samples.** A single field blank sample was collected on 9/6/19. The results for all laboratory measurement parameters were less than the laboratory method detection limits, without exception.

  A single field duplicate sample collected for the month on 8/26/19, KYBST-43.3-(0.1) DUP. Precision, as demonstrated by the relative percent difference (RPD) results, were good within only two evaluations in excess of 30% RPD. All precision evaluations greater than 12% were based on comparison of estimated sample concentrations reported between the laboratory method and reporting limits (MDLs and RLs, respectively). No additional data qualification was applied due to these observations.

Review of Results

- No additional data qualification were added to sample data based on available field or laboratory QC results.

MEMORANDUM

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000
Fax (703) 385-6007

Integrated Water Management

Date: November 12, 2019

To: Cheryl Atkinson, EPA COR

From: John O'Donnell, Dave Montali, Mark Sievers

Subject: Tug Fork Statement of Quality Assurance – October 2019

Tetra Tech completed one sampling round for the Tug Fork River watershed during this reporting period over two days on October 7 and 8, 2019. Tetra Tech reviewed the analytical results for potential quality concerns. Below are the major findings of our quality assessment for the two rounds of data.

Water Quality Sampling

- There were no apparent deviations from the project SOPs/QAPP during October's sampling event.

Water Quality Analysis

- **Holding Times.** The analytical holding time for total dissolved solids (TDS) was exceeded for the field blank. The field blank was analyzed eight days after the holding time of 7 days. Conductivity was measured in the field for the blank and was less than 1% of any of the associated sample measurements. While the holding time was lapsed by more than 2 times the technical holding time, it does not affect usability of the associated samples. TDS and conductivity are correlated with dissolved mineral content and generally follow similar patterns in natural waters.
- **Result Qualifiers**. Results for dissolved aluminum (Wolf, Blackberry and Knox Creeks), dissolved iron (Wolf, Big, Blackberry, and Peter Creeks), and total aluminum (Blackberry and Peter Creeks) had measured concentrations reported below the laboratory reporting limits. These results were listed as estimated. While the analytical method results clearly suggest the presence of these elements or measurement parameters, the values reported are less than the demonstrated range of accuracy and should be considered estimates. Conversely, the fecal coliform bacteria result for Pond Creek was reported as an estimate due to concentrations exceeding the method range at the measured dilutions. These results should be considered minimum values.
- **Quality Samples.** A single field blank sample was collected on 10/8/19. The results for all laboratory measurement parameters were less than the laboratory method detection limits, without exception.

A single field duplicate sample was collected from Knox Creek, sample KYBST-46.4-(0.1) DUP on 10/8/19. Precision, as demonstrated by the relative percent difference (RPD) results, were good within only the result for fecal coliforms observed in excess of 20% RPD. All other precision evaluations were less than or equal to 18% RPD for field and laboratory measurements. No additional data qualification was applied due to these observations.

Review of Results

- No additional data qualifications were added to sample data based on available field or laboratory QC results.

MEMORANDUM

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000
Fax (703) 385-6007

Integrated Water Management

Date: January 23, 2019

To: Cheryl Atkinson, EPA COR

From: John O'Donnell, Dave Montali, Mark Sievers

Subject: Tug Fork Statement of Quality Assurance – December 2019

Tetra Tech completed one sampling round for the Tug Fork River watershed during this reporting period over two days on December 11 and 12, 2019. Tetra Tech reviewed the analytical results for potential quality concerns. Below are the major findings of our quality assessment for the December 2019 sampling data.

Water Quality Sampling

- Field measurements were noted on custody records, where two samples, KYBST-41.4 (0.1) Blackberry Creek and KYBST 33.2 (0.1) Pond Creek, had temperatures in excess of 6 degrees Celsius (°C) at 6.1 and 6.8°C, respectively for the samples collected on December 11. Lab sample temperature information recorded during inspection indicates that samples were received within specification "OK", and that there was no non-conformance associated with the shipments. on receipt at the laboratory, here were no apparent deviations from the project SOPs/QAPP.

  There were 7 field measurement values with rounding errors or were incorrectly transcribed. The laboratory was notified and the data was corrected.

Water Quality Analysis

- **Holding Times.** All analytical holding times were met for the reported analyses. The field blank revealed trace levels of dissolved iron, total chloride, and total sulfate. All sample results for chloride and sulfate were more than ten times the value observed in the field blank, and are reported without further qualification. All of the sample results for dissolved iron were within 10 times the level observed in the field blank, and were qualified "K" to reflect that they are estimated maximum results, because the contribution from the field blank is not readily known. None of the sample values exceeds 10 times the MDL (all are less than 0.1 mg/L).

- **Result Qualifiers**. The field blank revealed trace levels of dissolved iron, total chloride, and total sulfate. All sample results for chloride and sulfate were more than ten times the value observed in the field blank and are reported without further qualification. All of the sample results for dissolved iron were within 10 times the level observed in the field blank and were qualified "K" to reflect that they are estimated maximum results, because

the contribution from the field blank is not readily known. None of the sample values exceeds 10 times the MDL (all are less than 0.1 mg/L).

For fecal coliforms, samples from Blackberry, Peter, Wolf, and Big creek exceeded the range of dilutions prepared, and were noted as estimated from the laboratory. In assessment, an "L" qualifier was added to the samples to reflect that the reported values may be minimum values or biased low due to the bacterial density exceeding the upper range of estimation with the dilution series analyzed under the method.

Universally, results reported between the MDL and RL have been qualified as estimated values with a "J". Results for dissolved iron had measured concentrations reported below the laboratory reporting limits.

- **Quality Samples.** As described, a field blank sample was collected on 12/11/2019, and analyzed for the full suite of measurement parameters. The blank revealed trace levels of total chloride and sulfate, as well as dissolved iron. Only results for dissolved iron were within 10 times the observed sample concentrations. Data qualification is discussed in the previous section.

  A single field duplicate sample was collected from Blackberry Creek, sample KYBST-44.4-(0.1) DUP on 12/11/2019. Precision, as demonstrated by the relative percent difference (RPD) results, were good with only the results for fecal coliforms, total suspended solids, and dissolved aluminum observed in excess of 20% RPD. The dissolved aluminum exceeded the guidance only marginally at 23% RPD, while the value for total suspended solids (40%) may support the differences observed in bacterial density. As the fecal coliform data were already qualified, no additional qualification was added for the apparent precision deficit. All other precision evaluations were less than or equal to 2% RPD for laboratory measurements. No additional data qualification was applied due to these observations.

Review of Results

- Aside from the discussion of data qualification and correction above, no additional data qualifiers or corrections were required based on available field or laboratory QC results.

MEMORANDUM

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000
Fax (703) 385-6007

Integrated Water Management

Date: February 6, 2020

To: Jennifer Sincock, EPA COR

From: John O'Donnell, Dave Montali, Mark Sievers

Subject: Tug Fork Statement of Quality Assurance – January 2020

Tetra Tech completed one sampling round for the Tug Fork River watershed during this reporting period over two days on January 6 and 7, 2020. Tetra Tech reviewed the analytical results for potential quality concerns. Below are the major findings of our quality assessment for the January sampling data.

Water Quality Sampling

- All samples were collected and hand-delivered to the laboratory on each working day. Lab sample temperature information recorded during inspection indicates that samples were received within specification and that there was no non-conformance associated with the shipments. There were no apparent deviations from the project SOPs/QAPP.

Water Quality Analysis

- **Holding Times.** All analytical holding times for TMDL/WAB samples were met for the reported analyses, without exception. WVDEPs Watershed Assessment Branch 2018 Field Sampling Standard Operating Procedures (WAB Field SOP 2018) describe alternate holding times for pathogens than those approved at 40CFR Part 136.

- **Result Qualifiers**. In assessment, an "L" qualifier was added to two of the fecal coliform bacteria samples (KYBST-43.3, Peter Creek and KYBST-7.1 Rockcastle Creek) which were qualified as estimated by the laboratory without additional discussion. The L qualifier indicates that the reported values may be minimum values or biased low. This potential bias was applied out of an abundance of caution, as the laboratory reported the sample values as estimates without any additional descriptive reasoning.

  Universally, results reported between the MDL and RL have been qualified as estimated values with a "J". Several sample results for dissolved aluminum and iron, one total aluminum, and one value for total suspended solids were reported as estimated due to measured concentrations reported below the laboratory reporting limits.

- **Quality Samples.** As described, a field blank sample was collected on 1/7/20, and analyzed for the full suite of measurement parameters. The blank revealed only trace

levels of total sulfate below the reporting limit. As all of the samples contained sulfate at more than 100 times the blank value, no qualification was applied.

A single field duplicate sample was collected at Big Creek, sample KYBST-28.1 DUP on 1/7/20. Precision, as demonstrated by the relative percent difference (RPD) results, was good with only the results for fecal coliforms, total suspended solids, and dissolved aluminum observed in excess of 20% RPD. The dissolved aluminum exceeded the guidance only marginally at 27% RPD, while the value for total suspended solids (59%) may support the differences observed in bacterial density at 24% RPD. As the fecal coliform data were already qualified, no additional qualification was added for the apparent precision deficit. All other precision evaluations were less than or equal to 10% RPD for laboratory measurements without exception. No additional data qualification was applied due to these observations.

Review of Results

- Aside from the discussion of data qualification and correction above, no additional data qualifiers or corrections were required based on available field or laboratory QC results.

MEMORANDUM

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000
Fax (703) 385-6007

Integrated Water Management

Date: March 27, 2020

To: Jennifer Sincock, EPA COR

From: John O'Donnell, Dave Montali, Mark Sievers

Subject: Tug Fork Statement of Quality Assurance – February 2020

Tetra Tech completed one sampling round for the Tug Fork River watershed during this reporting period over two days on February 11 and 12, 2020. Tetra Tech reviewed the analytical results for potential quality concerns. Below are the major findings of our quality assessment for the February sampling data.

Water Quality Sampling

- All samples were collected and delivered to the laboratory on each working day, as is apparent from sampling and analysis times for short holding time fecal coliforms analysis. There were no apparent deviations from the project SOPs/QAPP.

Water Quality Analysis

- **Holding Times.** All analytical holding times were met for the reported analyses without exception.
- **Field data**: The electronic data deliverable for sample KYBST-46.4, Knox Creek, does not include the field measurement for specific conductance recorded on field sheets as 164 micromhos per centimeter (µmhos/cm). All other samples have both field and laboratory measurements; however, the precision between the field sheet and the laboratory measurements for all other samples is considerably better than observed for Knox Creek. While no apparent notation was observed indicating that the field measurement was suspect, the laboratory data are likely more reliable for this sample, as none of the other samples revealed a measurement less than 200 µmhos/cm, and the average throughout the watershed is in the 300 range.
- **Result Qualifiers**. Data for fecal coliforms in several samples were reported as estimated from the laboratory. While it appears that two samples might have exceeded the range of normal dilutions (KYBST-43.3 and 46.4, Peter Creek and Knox Creek, respectively), there are no notes describing the reason for the estimated flag in three others (Rockcastle, Wolf, and Big Creeks).

  Universally, results reported between the method detection limit (MDL) and reporting limit (RL) have been qualified as estimated values with a "J". Four samples have results

for chloride between the MDL and RL and have been appropriately qualified. No additional data qualification was required for this sampling event's data.

- **Quality Samples.** A field blank sample was prepared on 2/12/2020, and analyzed for the full suite of measurement parameters. The blank revealed no reportable quantities of any of the project analytes of interest.

  A single field duplicate sample was collected at Big Creek, sample KYBST-28.1 DUP on 2/12/2020. Precision, as demonstrated by the relative percent difference (RPD) results, was good with no results above 20%RPD.

Review of Results

- No additional data qualifiers or corrections were required based on available field or laboratory QC results.

MEMORANDUM

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030
Telephone (703) 385-6000
Fax (703) 385-6007

Water Division – Northeast

Date: May 4, 2020

To: Jennifer Sincock, EPA COR

From: John O'Donnell, Dave Montali, Mark Sievers

Subject: Tug Fork Statement of Quality Assurance – March 2020

Tetra Tech completed one sampling round for the Tug Fork River watershed during this reporting period over two days on March 24 and 25, 2020. Tetra Tech reviewed the analytical results for potential quality concerns. Below are the major findings of our quality assessment for the February sampling data.

Water Quality Sampling

- All samples were collected and delivered to the laboratory on each working day. The laboratory failed to sign the chain of custody records for the March 24 sample delivery on receipt. There are only relinquished signatures, despite evidence of sample inspection. There were no other apparent deviations from the project SOPs/QAPP.

Water Quality Analysis

- **Holding Times.** All analytical holding times were met for the reported analyses without exception.
- **Field data**: All samples have both field and laboratory measurements for measurements for specific conductance, and, for all but the sample from Blackberry Creek, demonstrate good relative agreement between field and laboratory measurements with precision estimates of less than 20% relative percent difference (RPD). The values from KYBST-41.4 resulted in a 42% RPD precision estimate when the two methods were compared. While there are no indications as to the reason for the single sample disagreement, the laboratory measurement is likely more reliable based on its correlation to total dissolved solids relative to the remaining samples collected during the sampling event.
- **Result Qualifiers**. Universally, results reported between the method detection limit (MDL) and reporting limit (RL) have been qualified as estimated values with a "J".

  Data for fecal coliforms in samples from Knox and Wolf Creeks were qualified as "Est." indicating an estimated value. These two samples are the only fecal coliform results qualified as such and they are the lowest sample results; therefore, it appears that the samples might have been initially prepared at a high dilution. No additional data qualification was required for this sampling event's data.

- **Quality Samples.** A field blank sample was prepared on March 25, and analyzed for the full suite of measurement parameters. The blank revealed only an estimated value for sulfate at just over 1% of the lowest environmental sample. No qualification was applied based on blank results.

  A single field duplicate sample was collected at Big Creek, sample KYBST-28.1 DUP on March 25. Precision, as demonstrated by the RPD results, was good with no results above 20%RPD (all were less than or equal to 14% RPD).

Review of Results

- No additional data qualifiers or corrections were required based on available field or laboratory QC results.